North Carolina Department of Transportation
Highway – Railroad Interconnection and Preemption Inspection Form

Date of Inspection: _____ Recorded By: _____

Inspection Team Members: _____

_____

Signal Inventory No.: _____ DOT Crossing No.: _____

Railroad Co: Select Railroad _____ RR Representative: _____

Railroad Milepost: _____ RR Rep. Phone: (_____)_____

Division: DIV___ County: _____ City or Town: Select _____

Date of Last Inspection: _____

Intersection

Route Number: _____ Name: _____

at

Route Number: _____ Name: _____

It is important to note that in doing these inspections, there are three primary objectives that you are to achieve:

- **Verify that the total railroad warning time is adequate to accommodate preemption time required by signal plans.**
- **Identify railroad preemption phasing and timing required for traffic signal.**
- **Verify operation and condition of both railroad and traffic signal control equipment.**
- **Verify safe operation of preemption sequence and ensure that vehicles are clear of crossing dynamic envelope as train approaches.**

General Information

1. **Using Signal Plans** – Make sure the location is the correct location by checking the following items:
   a. Signal inventory number shown on the signal plans is the same as shown on the signal cabinet.
   b. All street names and route numbers in the field are the same as shown on the plans.

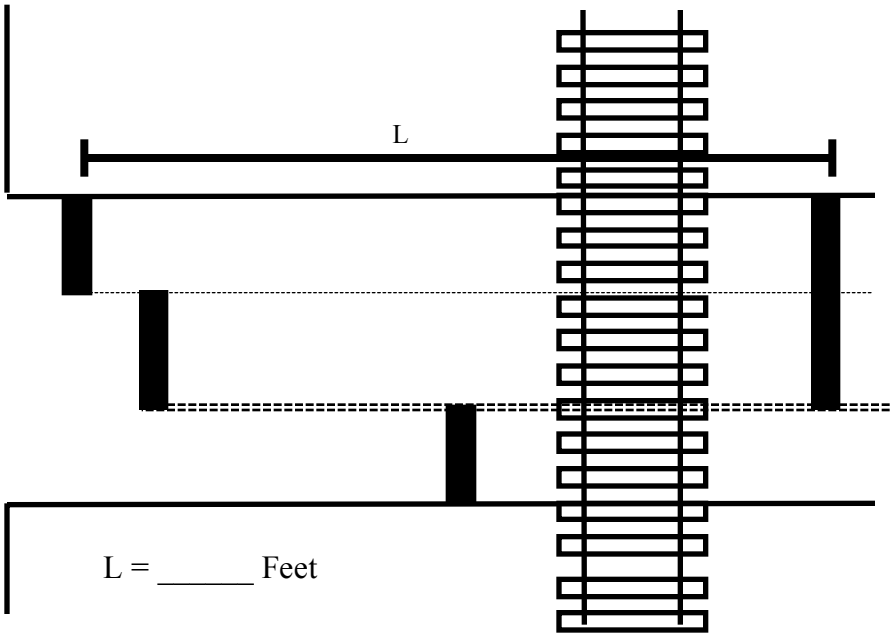
c. DOT Railroad Crossing Number, which should be posted on the Railroad equipment.
d. Name of Railroad Company operating on tracks at location.

2. Take **photos** (*if new installation or major upgrade*) to show:
   a. All intersection and track approaches,
   b. Clear location of tracks as it relates to the intersection,
   c. Location of traffic signal cabinet and railroad cabinet/bungalow,
   d. Inside of traffic signal cabinet to show equipment,
   e. Inside of railroad signal cabinet/bungalow to show equipment,
   f. Span/metal pole arrangement showing signal heads and signs,
   g. Pavement markings and locations of stopbars and crosswalks.

Geometric Inspection

3. Calculate track clearance green by current standard (Greenshield's formula).

Distance To Measure To Calculate Track Clearance Green Time
(Greenshield's Formula)



If an approach has multiple stopbars, measure the distance from the stopbar behind the track to the farthest stopbar (closest to intersection).

Measure from stopbar behind track to stopbar at intersection. If calculation is less than 10 sec., use 10 sec. minimum.

a.) Calculation for above:
2 sec. x L/20 (L = distance divided by 20 feet per car)
+ 4 sec. (start-up delay)
_____ Seconds = Greenshield's Formula Green Time

b.) If Simultaneous Preemption is used, total amount of Track Clear Green required is Greenshield's Formula Green Time = [ ] Seconds

c.) If Advance Preemption is used, calculate Track Clear Green Time:

Amount of Advance Preemption = _____ (Min Green)
(Should be 6-8 Seconds) + _____ (Ped Clear)
+ _____ (Yellow Clear Before Preempt)
+ _____ (Red Clear Before Preempt)
Amount of Advance Preemption = [ ] Seconds
+ Greenshield's Formula Green (From 3a): _____
Total Amount of Track Clear Green Time = [ ] Seconds

You will need to enter the appropriate calculated Track Clearance Green time into the chart in Item 10 of this form.

d.) Is the calculated time above for the type of preemption used at this crossing (advance or simultaneous) consistent with what is shown on the signal plans and/or programmed in the field? Select

4. Compare actual intersection geometrics with what is shown on the signal design plans. (This check includes stopbar locations, LED signal head displays and configuration, signing, etc.) List any differences below: _____
_____

Note any additional signing needs (example: "*DO NOT STOP ON TRACK*", "*LOW VEHICLE MAY DRAG", "ONCOMING TRAFFIC MAY HAVE [HAS] EXTENDED GREEN"* etc.). _____
_____
_____

Traffic Signal Operation Inspection

5. Intersection Operation: Actuation Type

6. Do vehicle and pedestrian heads (if present) appear to be L.E.D. and conform to the current design standards? Select

NOTE: Countdown pedestrian heads should not be used at railroad preemption locations.

7. Are pedestrian signal heads programmed to clear concurrently with Yellow Clear Before Preempt? Select

8. Are blankout signs Fiber Optic or L.E.D.? Select

9. Note controller timing for preemption operation. Compare timing shown on the signal plans to times programmed into controller in field. The Appendix may be used to document the times if needed. If timing requires changing, cross out existing time and circle new time.

10. Calculate the total preemption warning time required based on the type of crossing warning system used at this location (Also Enter this Time in Item 34a):

If 4 Quadrant / Exit Gates are Present:

Function	Seconds
Equipment Reaction Time	4
Delay Time	
Min Green Before Preempt	
Ped Clear Before Preempt #	
Yellow Clear Before Preempt*	
Red Clear Before Preempt*	
Track Clearance Green	
Exit Gate Drop Time	11
Gates Horizontal Before Train	5
Total Warning Time Required	

If No Gates or 2 Quadrant Gates:

Function	Seconds
Equipment Reaction Time	4
Delay Time	
Min Green Before Preempt	
Ped Clear Before Preempt #	
Yellow Clear Before Preempt*	
Red Clear Before Preempt*	
Track Clearance Green	
Track Clearance Yellow	
Track Clearance Red	
Total Warning Time Required	

If Ped Clear Time is timed concurrently with Yellow Clear Before Preempt, enter only the exclusive amount of Ped Clear Time that is not displayed concurrently with the Yellow Clear.

* For Yellow and Red Clear Before Preempt, use the times shown on plans and controller if Overlap P (**D) is used. If 0.0 is shown on the plans and programmed on the controller, use the yellow and red clearance times for the normal phase that has the highest total clear time required. If this phase is the Track Clearance Phase, use the times for the next highest phase.

** *Note: Overlap P is available on all 2070 controllers and some types of NEMA controllers. On some older NEMA controllers, Overlap D (or the last overlap available) is used instead.*

For Track Clearance Green, use the time calculated in Item 3 for the type of preemption used.

11. Is the phase/movements used during the Track Clearance phase also an exclusive phase/move during normal operation? (No, if normal phase also has an overlapping turning movement that does not operate during Track Clearance phase.) Select

    If Yes, are all parent phases used in normal operation programmed for Overlap "P" ("D") on the controller. Select

    Is Track Clearance Phase programmed as an exclusive phase that does not operate during normal operation (ex, TC Phase = Phase 9)? Select

12. Observe operation of the signal, including control equipment in the cabinet and field equipment for proper operation. Is equipment operating properly and does the operation coincide with the signal plans? Select

If No, identify any malfunctions or discrepancies observed. Include: bulbs out, signal heads in need of repair, pavement conditions, pavement markings, signage, etc. _____
_____
_____

13. If protective/permissive phasing is used and/or "yellow trap" backup protection is required for normal signal operation, ensure Phase Omits are used and NOT Red Revert. Select

14. Activate the railroad preemption sequence from the cabinet and observe operation.

    Does sequence match the signal plans? Select
    Does preemption override minimum green times? Select
    If no, list reasons for nonconformance here: _____
    _____
    _____

15. If intersection has multiple preempts programmed, verify that Railroad Preempt is highest priority. Select

16. If crossing has multiple through line tracks, perform second train sequence test (preempt re-service). Does **preempt call release** immediately when gates **begin** to rise? Select

    Note: This is very important to the correct operation of preempt re-service.

Traffic Signal Electrical Inspection

17. Signal equipment manufacturer (controller, cabinet and conflict monitor)

    Type of Controller : Select **Other:** _____
    Controller Manufacturer and Model**:** _____
    Type of Cabinet: Select **Other:** _____
    Cabinet Manufacturer and Model**:** _____
    Conflict Monitor/MMU: _____

18. Cabinet Mounting: Select

19. Discuss location with Traffic Signal Technician Supervisor and note any issues or recent trouble calls at this location (maintenance problems, spares, etc.): _____
    _____
    _____

20. Check to make sure that phases used only during preemption are omitted during normal operation. Select

21. Check track interconnect circuit (relay for NEMA, AC isolator for 170 and 2070) for conformance to fail safe operation (normally energized). Select

22. Perform the following tests while signal is in **flash mode**:

    a.) Check **blankout sign(s)** during flash (make sure controller switch is off during test). Blankout sign(s) should still illuminate for preemption during flash. Select

    b.) Check **flash color** of signals. Do flash colors match signal plans? Select

    c.) Check **start-up sequence**. Select

23. Ensure that the controller is not programmed for late night flash. Select

Railroad Crossing Signal Electrical Inspection

24. Identify the railroad signal warning equipment used (advance signal heads, flashers, cantilevers, 4 quadrant gates, etc.)_____
    _____

25. What is the condition of the interconnect circuit / contact in the railroad cabinet and/or junction box? _____
    _____

26. Identify the general type of railroad signal equipment (motion detector, predictor, ac/dc, etc.)
    _____

27. Perform the following tests with a shunt placed across the rails in the island circuit or while a train is present:

    a.) Observe traffic signal **preemption operation**. Select

    b.) Examine **RR flashers** and focus. Select

    c.) Examine **RR flash sequence** (all approaches should alternate together). *Note: Gate tip light burns solid.* Select

    d.) Observe when preempt call to traffic signal is released. Preempt call should be released as soon as practical. Preempt Select

28. What is the general condition of the railroad-crossing surface? Select

    Details: _____

    Type of Crossing Surface: Select

    1) Section Timber
    2) Full Wood Plank
    3) Asphalt
    4) Concrete Slab
    5) Concrete Pavement
    6) Rubber
    7) Metal Sections
    8) Other Metal
    9) Unconsolidated
    10) Other _____

Railroad Crossing Signal Track Circuit Inspection

29. Obtain the circuit length as shown on plan of record in the railroad signal cabinet. *(Measure from edge of travel lane/impact area)*

From Plans – Direction Approach: _____ Direction Approach: _____

Measured in Field – Direction Approach: _____ Direction Approach: _____

30. Check the condition of bonds (Head Bonds & Long Bonds) _____

31. Obtain maximum train speed for the crossing from railroad maintainer / inspector (*using Timetable Speed or Railroad Permanent Speed Restriction*).

Railroad Direction Approach: _____ MPH

Railroad Direction Approach: _____MPH

(NOTE: City / Town ordinance does not apply – federal preemption of local or state laws, RR activities are interstate commerce)

32. Calculate amount of warning time provided by track circuitry: _____ Seconds

(Shortest Approach Length) (Minus) Equipment Reaction Time
(1.47) (Train Speed in MPH)

33. Is crossing signal equipped with **advance preemption**? Select

Note: If advance preemption is utilized, an actual train movement **must** be observed.

Observed total warning time of actual train movement: _____ Seconds

34. If Railroad crossing signal equipment is designed for constant warning time (i.e. predictor):

a) How much warning time is programmed in the unit? _____ Seconds

b) How much time does railroad program for flashers to flash before train arrival? _____ Seconds

c) If railroad provides advance preemption, how many seconds of advance warning time is programmed? _____ Seconds

NOTE: The total of b) and c) above should equal the total amount of warning time programmed in the predictor (a) if advance preempt is used (a = b+c OR a-b = c).

35. Compare preemption time required with RR advance warning time.

a) Total Preemption Warning Time Required (from Item 10): _____ Seconds

b) Total Warning Time Programmed on Railroad Predictor (if used) (from Item 34a): _____ Seconds

c) Total Warning Time Available from Track Circuitry (From Item 32):_____ Seconds

Track Circuitry Warning Time (c) should be greater than or equal to the Total Preemption Time Required (a) and the time programmed on the predictor (b) (if used). If (a) and/or (b) is greater than (c), immediate action must be taken (a <= b <= c).

Documentation

36. Mark-up a copy of the signal plan (if necessary). Show any field changes in red. The team leader should sign and date the changes on the plan and submit them to Traffic Engineering for an updated Plan of Record.

37. Document any changes made in the field. (i.e. timing, etc.) _____
_____
_____
_____

38. Are there any suggested signal / railroad revisions? (consider any geometric or environmental changes in the area.) _____
_____

39. General comments: _____
_____
_____
_____

Send copy of this Inspection Form and any marked-up plans to:

	Traffic Signal Issues	Rail Crossing Issues
Mail:	NCDOT Traffic Engineering Branch Signals and ITS Unit Attn: Rob Ziemba, PE 1561 Mail Service Center Raleigh N.C. 27699-1561	Mr. Drew Thomas, PE NCDOT Rail Division Engineering and Safety Branch Capital Yard 1556 Mail Service Center Raleigh, N.C. 27699-1556
Office/ Delivery:	700 N. Greenfield Pkwy, Suite 750 Garner, NC 27529 (919) 773-2800	Capital Yard 862 Capital Boulevard Raleigh, NC 27603 (919) 733-5564

Appendix A: 2070 Oasis

2070L OASIS	Plan (Sec.)	Field (Sec.)
Interval 1 – Track Clearance Green		
Interval 1 – Track Clearance Yellow		
Interval 1 – Track Clearance Red		
Interval 2 – Dwell Green (= 255 if dwell interval; See Note below)		
Interval 2 – Dwell Yellow * (Yellow Clear after Pre) or (TC 2 Yellow)		
Interval 2 – Dwell Red * (Red Clear after Preempt) or (Track Clear 2 Red)		
Interval 3 – Green (Used as Needed; See Note Below)		
Interval 3 – Yellow * (Used as Needed; See Note Below)		
Interval 3 – Red * (Used as Needed; See Note Below)		
Interval 5 – Exit Green (Normally 1 – denotes exit phase is used)		
Interval 5 – Yellow (Normally 0.0 sec. if exit interval)		
Interval 5 – Red (Normally 0.0 sec. if exit interval)		
Delay Time (Should be 0 sec.)		
Min Green Before Pre (Should be 1 sec.)		
Ped Clear Before Preempt		
Yellow Clear Before Preempt *		
Red Clear Before Preempt *		
Dwell Min Time		
Ped Clearance Through Yellow (Yes or No)		
Omit Overlaps		

* If 0.0 is shown/programmed for this time, use the appropriate yellow and red time for the phase with the highest total clearance time in normal operation.

Note: If a single track clearance phase is used, Interval 2 is used to denote the Dwell Interval and Yellow and Red Clear times after preempt. If 2 Track Clearance phases are used, enter times for 2nd Track Clearance Phase in Interval 2 and use Interval 3 for Dwell times.

Preempt Dwell Interval is set by entering 255 for green time of particular interval. If interval is set as dwell, then the following yellow and red intervals will function as "Yellow Clear After Preempt" and "Red Clear After Preempt" respectively.

Track Clearance Phase(s): _____ Preempt Dwell Phase(s): _____

Preempt Exit Phase(s): _____

Revised: July 2007

Appendix B: NEMA Equipment

TRACONEX		Plan (Sec.)	Field (Sec.)
Delay Before Preempt	**N\A**	**N\A**	**N\A**
Minimum Walk Before Preempt	**N\A**	**N\A**	**N\A**
Pedestrian Clearance Before Preempt	**TPC**		
Minimum Green Before Preempt	**N\A**	**N\A**	**N\A**
Yellow Clearance Before Preempt	**TY1**		
Red Clearance Before Preempt	**TR1**		
Track Clearance Green	**TCM**		
Track Clearance Yellow Clearance	**TY2**		
Track Clearance Red Clearance	**TR2**		
RR Dwell Minimum Green	**TPM**		
Yellow Clearance After Preempt	**TY4**		
Red Clearance After Preempt	**TR4**		

Track Clearance Phase(s): _____ Preempt Dwell Phase(s): _____

Preempt Exit Phase(s): _____

ECONOLITE ASC-8000 & ASC/2-2100 and EAGLE EPAC 300		Plan (Sec.)	Field (Sec.)
Delay Before Preempt	**DELAY TIME**		
Minimum Walk Before Preempt	**N\A**	**N\A**	**N\A**
Pedestrian Clearance Before Preempt	**MIN PED CLEAR**		
Minimum Green Before Preempt	**MIN GREEN**		
Yellow Clearance Before Preempt*	**MIN YELLOW**		
Red Clearance Before Preempt*	**MIN RED**		
Track Clearance Green	**TRACK CLEAR GREEN**		
Track Clearance Yellow Clearance	**TRACK CLEAR YELLOW**		
Track Clearance Red Clearance	**TRACK CLEAR RED**		
RR Dwell Minimum Green	**HOLD GREEN**		
Yellow Clearance After Preempt*	**HOLD YELLOW**		
Red Clearance After Preempt*	**HOLD RED**		
Ped Clear Through Yellow			
Omit Overlaps			

* If 0.0 is shown/programmed for this time, use the appropriate yellow and red time for the phase with the highest total clearance time in normal operation.

Track Clearance Phase(s): _____ Preempt Dwell Phase(s): _____

Preempt Exit Phase(s): _____

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PEEK/TRANSYT 3000		Plan (Sec.)	Field (Sec.)
Delay Before Preemption	**PRE-EMPT DELAY** MUST HAVE TRACK CALL FOR MORE THAN 1.5 SEC.		
Minimum Walk Before Preempt	**N\A**	**N\A**	**N\A**
Pedestrian Clearance Before Preempt	**PED CLEAR**		
Minimum Green Before Preempt	**MIN ENTRY TIME**		
Yellow Clearance Before Preempt	**MIN ENTRY YELLOW**		
Red Clearance Before Preempt	**MIN ENTRY RED**		
Track Clearance Green	**INTERVAL 1**		
Track Clearance Yellow Clearance	**INTERVAL 2**		
Track Clearance Red Clearance	**INTERVAL 3**		
RR Dwell Minimum Green	**INTERVAL 4**		
Yellow Clearance After Preempt	**INTERVAL 5**		
Red Clearance After Preempt	**INTERVAL 6**		

Track Clearance Phase(s): _____ Preempt Dwell Phase(s): _____

Preempt Exit Phase(s): _____

LMD 8000 (PEEK/TCT 9200)	Plan (Sec.)	Field (Sec.)
Delay Before Preemption		
Minimum Walk Before Preemption		
Pedestrian Clearance Before Preemption		
Minimum Green Before Preemption		
Yellow Clearance Before Preemption		
Red Clearance Before Preemption		
Track Clearance 1 Green		
Track Clearance 1 Yellow Clearance		
Track Clearance 1 Red Clearance		
Track Clearance 2 Green		
Track Clearance 2 Yellow Clearance		
Track Clearance 2 Red Clearance		
RR Dwell Minimum Green		
Yellow Clearance After Preemption		
Red Clearance After Preemption		

Track Clearance Phase(s): _____ Preempt Dwell Phase(s): _____

Preempt Exit Phase(s): _____

Appendix C: 170 Bi-Trans

170 Bi-Trans		Plan (Sec.)	Field (Sec.)
Delay Before Preempt	**RR 2 DLY**		
Track Clearance Green	**RR 2 CLR**		

Track Clearance Phase(s): _____

Preempt Dwell Phase(s) [RR 2 LTD SRV]: _____

RESET